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ON A MANUAL FOR INTRODUCING TIMBER ENGINEERING DESIGN IN DEVELOPING COUNTRIES*

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1. SCOPE

The purpose of the proposed manual is to introduce an instant design capabilty in timber engineering to a developing country that previously had none. It will be assumed that the country has engineers that have been trained in the basic concepts of structural engineering, but who have no prior knowledge of timber as a structural material.

The four essential Parts of the manual will be the following:

Part 1. Terms and Definitions
Part 2. Classification Procedures
Part 3. Design Code
Part 4. Worked examples

In addition to the above, there are three others sets of information that may be required, depending on the technology base of the country intending to engage in timber engineering.

For countries with no previous experience in timber construction, the following Parts will be required,

Part 5. Selection and Specification of Timber
Part 6. Detailing of timber structures
Part 7. Construction
Part 8. Maintenance

For countries with a limited background in structural design technology the following Parts may be required,

Part 9. Structural analysis
Part 10. Minimum design loads

Finally the following two Parts could be added to stretch the design capability of the manual,

Part 11. Composite structures
Part 12. High hazard loads

In addition to the above, it is desirable that a commentary be prepared, explaining the technical background of the various Parts of the manual, and stating the structural performance expected of designs that comply with the recommendations.

2. CONSTRUCTION OF THE MANUAL

The overriding consideration in drafting the various Parts of the manual should be that they be readily understood. As timber structures by their very nature have complex characteristics, the necessary simplifications will generally lead to conservatism in design. However once timber engineering (and the necessary industry infrastructure to support it) have been introduced into a country, the technology can be expanded through an evolutionary process towards that of developed countries.

It is proposed that the first draft of the manual be based on existing Australian standards. This is suggested for two reasons. First, these standards have been used as a basis for UNIDO projects in the past; thus their value has been proven, UNIDO field officers are familiar with the system and so they could be used to produce useable manuals within a short period of time. The second and an important reason is that the Australian standards have a format that is suitable to the range of species and the technology infrastructure that is available in most developing countries. In this context it is of interest to note that the timber of more than 1000 species that grow in developing countries have been formally classified into structural groups according to the Australian system (Berni *et al.*, 1979; Bolza and Keating, 1972; Keating and Bolza, 1982).

A suggestion for future modifications of this manual is that once suitable ISO standards have been developed and accepted, the manual be modified to mesh in with these standards; this will facilitate the evolution to more sophisticated technology for countries that have successfully introduced timber engineering. Of course, it goes without saying that the manual should line up with any other documents developed

by UNIDO, such as for example UNIDO recommendations for visual grading rules.

The design procedure proposed for the first version of the manual is the 'working stress' format rather than the more modern 'limit states' format, as the former would probably be more familiar to engineers in developing countries. Similarly, the language used will be English and the units used the international SI units; it is envisaged that eventually several versions of the manual will be produced in a combination of language and units to suit the needs of various developing countries.

3. COMMENTARY ON PARTS 1-12

3.1 Part 1. Terms and Definitions

This Part will contain a definition of terms used in the manual that may not be familiar to an engineer inexperienced in timber engineering. For a more comprehensive glossary reference will be made to the standard AS 01-1964 (Standards Association of Australia, 1964)

3.2 Part 2. Classification Procedures

The classification procedures used in Part 2 will be based on simplifications of those given in the documents AS 2082, AS 2099, MP45, AS 1720 (Standards Association of Australia, 1977a; 1977b; 1979 and 1982). As indicated earlier, this classification system has already been applied to the timber of more than 1000 species that grow in developing countries.

3.3 Part 3. Timber Engineering Design Code

This will be based on a simplification of AS 1720-1975 (Standards Association of Australia, 1982). To ensure simplicity, the contents of Part 3 will be limited to considerations of rectangular sawn timber members, pole timbers, nailed joints and bolted joints.

3.4 Part 4. Worked Examples

Examples will be chosen to illustrate the design Rules of Part 3.

3.5 Part 5. Selection and Specification of Timber

This Part should include consideration of matters related to timber durability, availability, sizes and moisture content at time of delivery. It could also contain information on methods to assure the quality of purchased products.

3.6 Part 6. Detailing of Timber Structures

This should include detailing of standard joints and also methods of mitigating the adverse effects of shrinkage in green timber.

3.7 Part 7. Construction

This Part would include recommendations related to avoiding adverse notching, to the fabrication of joints, the avoidance of buckling during erection, good practices for on-site storage of materials and acceptable tolerances in fabrication and erection.

3.8 Part 8. Maintenance

This Part would include description of techniques for coping with the effects of construction with green timber (for example the retightening of nuts on bolts), the inspection of structures to detect incipient or existing decay and remedial measures for any observed structural distress.

3.9 Part 9. Structural Analysis

This Part would include a set of equations for the stresses and deformations of simple structural members and systems; it would also include formulae for the conversion of structural parameters from one

set of units to another.

3.10 Part 10. Minimum Design Loads

This would be a simplified set of loads based on the document AS 1170 (Standards Association of Australia, 1975; 1981). These will be essentially wind loads and floor and roof live loads; they will be suitable for buildings that are not subjected to severe natural hazards such as hurricanes, earthquakes and floods.

3.11 Part 11. Composite Structures

Examples of useful composite construction would be spaced columns, boxed beams, I-beams, trusses, glued laminated timber and nailed laminated timber construction.

3.12 Part 12. High Hazard Loads

The intent of this part would be to provide simple methods for estimating high hazard loads such as earthquakes, hurricanes and floods. Advice will also be given in simple construction techniques for mitigating the effects of these hazards.

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